King Fahd University of Petroleum & Minerals
CIVIL ENGINEERING DEPARTMENT

CE 201 STATICS (Sections 3 & 4)

First Semester 1430-31 / 2009-10 (**091**)

H.W. # 12

Due on Sunday 2-2-1431 / 17-1-2010 **(any time)**

Deadline for submission: **Monday 3-2-1431 / 18-1-2010** (**before you sit in class**)

1- The arrangement shown in Fig. P1 exerts a horizontal force on the stationary crate. The crate weighs 800 N, and the coefficient of static friction between the crate and the ramp is $\mu_s = 0.4$. [Secs. 8.1 & 8.2] (15 pts.)

(a) If the rope exerts a 400-N force on the crate, what is the friction force exerted on the crate by the ramp?

(b) What is the largest force the rope can exert on the crate without causing it to slide up the ramp?

2- The refrigerator shown in Fig. P2 weighs 350 kN; b = 42 cm; the coefficient of static friction (μ_s) at A and B equals 0.24. [Secs. 8.1 & 8.2] (20 pts.)

(a) What force F is necessary for impending slip?

(b) If h = 180 cm, will the refrigerator tip over before it slips? Prove!

(c) If you want the refrigerator to slip before it tips over, what is the maximum height h at which you can apply the force F?

3- The coefficient of static friction between the right bar shown in Fig. P3 and the surface at A is $\mu_s = 0.6$.

(a) If $\alpha = 20°$, what is the magnitude of the friction force exerted at A (as a function of F)?

(b) What is the largest angle α at which the truss will remain stationary without slipping?

[Secs. 8.1 & 8.2] (20 pts.)

4- The masses of crates at A and B, shown in Fig. P4, are 25 kg and 30 kg, respectively. The coefficient of static friction between the contacting surfaces is $\mu_s = 0.34$. What is the largest value of α for which the crates will remain in equilibrium? [Secs. 8.1 & 8.2] (20 pts.)

5- In Fig. P5 shown, the coefficients of static friction between the tires of the 1000-kg tractor and the ground and between the crate and the ground are 0.8 and 0.3, respectively. The front wheels can turn freely.

(a) Starting from rest, what torque must the tractor's engine exert on the rear wheels to cause the crate to move if the mass of the crate is 450 kg?

(b) What is the most massive crate the tractor can cause to move from rest if its engine can exert sufficient torque? What torque is necessary? [Secs. 8.1 & 8.2] (25 pts.)

Note that solving five problems only on "Friction" is not enough to fully understand and master the subject! You need to practice more …..!!!

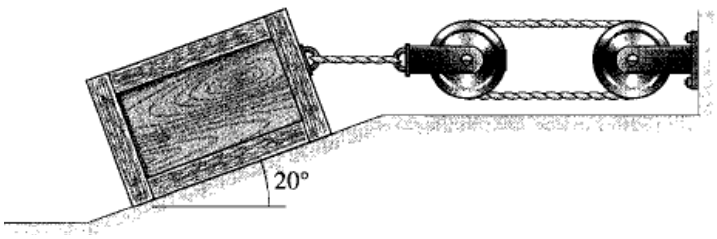

Fig. P1

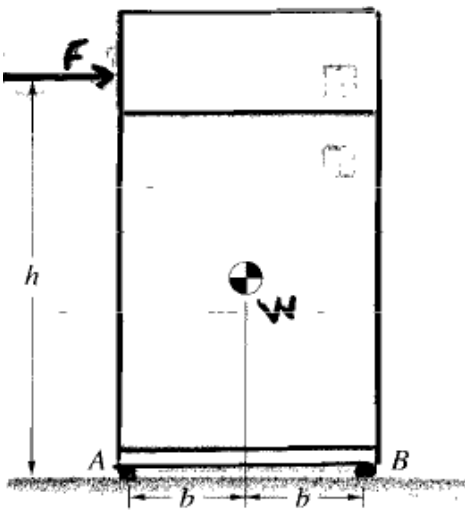

Fig. P2

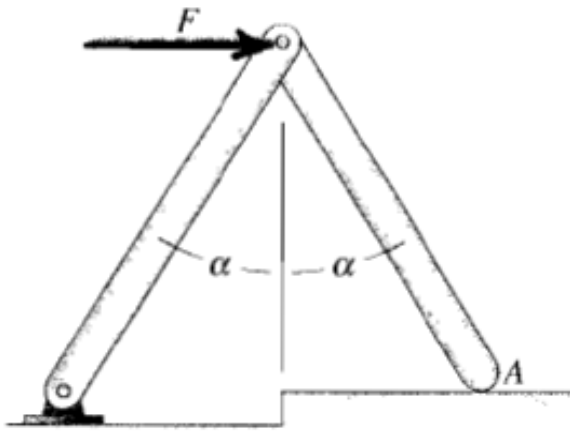

Fig. P3

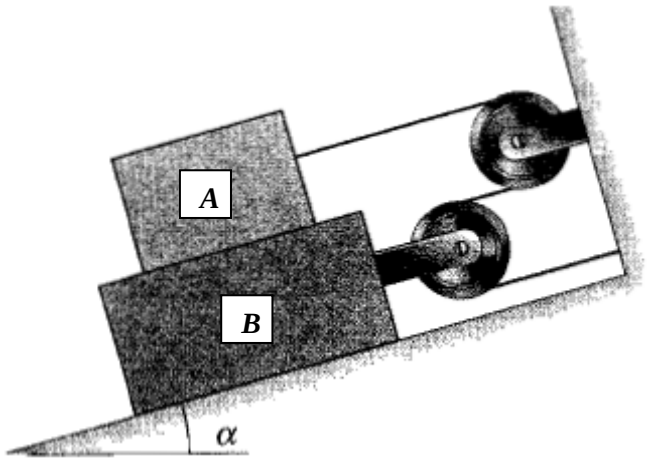

Fig. P4

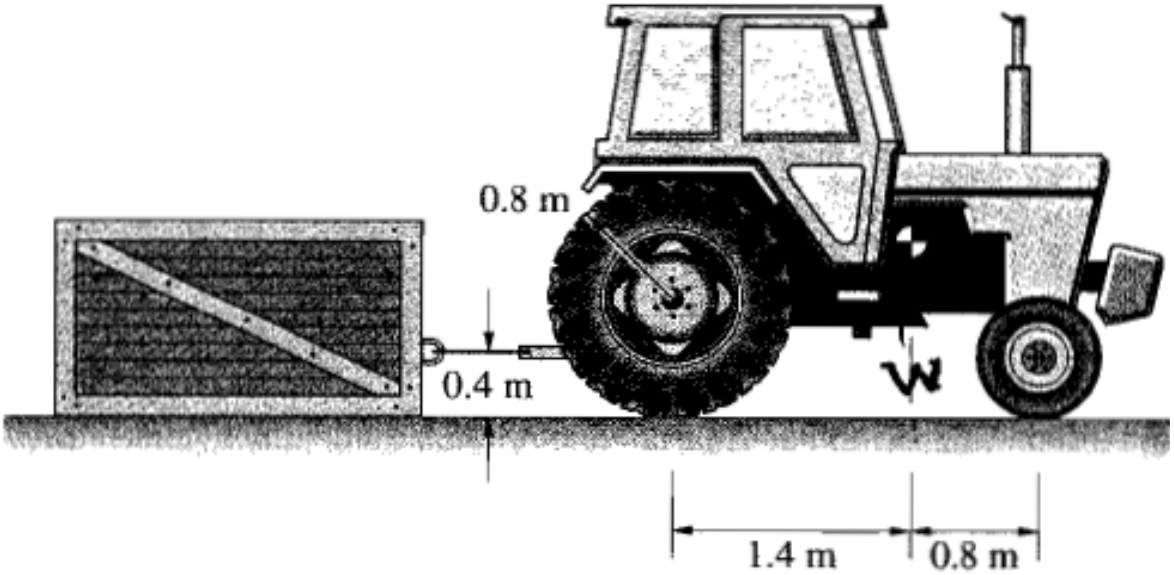

Fig. P5

Do <u>your</u> work *<u>yourself</u>*!! Remember that the homework carries more than 10% of the course grade; in addition, *solving it is the best way to understand the subject.* *Of course, you can seek my help anytime in the homework as well as in anything else.*

***As an <u>engineer</u>*, review the <u>guidelines for submitting homework assignments</u> given to you in class <u>BEFORE</u> you start solving and writing the homework. FOLLOW <u>*ALL*</u> THESE GUIDELINES. <u>*Cheating, copying, etc. is …….!!!!!!*</u>**